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***Indian Standard***

**SPECIFICATION FOR  
LEAD-ACID STORAGE BATTERIES FOR  
MOTOR CYCLES, AUTORICKSHAWS  
AND SIMILAR VEHICLES**

***( Second Revision )***

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BUREAU OF INDIAN STANDARDS  
MANAK BHAVAN, 9 AAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# *Indian Standard*

## SPECIFICATION FOR LEAD-ACID STORAGE BATTERIES FOR MOTOR CYCLES, AUTORICKSHAWS AND SIMILAR VEHICLES ( *Second Revision* )

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# ***Indian Standard***

## SPECIFICATION FOR LEAD-ACID STORAGE BATTERIES FOR MOTOR CYCLES, AUTORICKSHAWS AND SIMILAR VEHICLES

### **( *Second Revision* )**

#### 0 . F O R E W O R D

0.1 This Indian Standard was adopted by the Indian Standards Institution on 11 March 1980, after the draft finalized by the Secondary Cells and Batteries Sectional Committee, had been approved by the Electrotechnical Division Council.

**0.2** This standard was originally issued in 1957 and specified the requirements for motor cycle batteries. At the time of first revision in 1962, the details of internal construction of batteries were deleted and only external features, overall dimensions, tests and performance requirements were specified. The test for resistance to overcharge and air pressure test were also added. In 1966, through an amendment the scope of the standard was enlarged to cover requirements for batteries for autorickshaws and similar vehicles.

0.3 This second revision has been undertaken to update the requirements of such batteries and also to align it with IS : **7372-1974\*** and additional test for batteries intended for dyno-starting has been added.

0.4 An agreement between the purchaser and the supplier is called for under **7.1.1** and 7.1.2.

0.5 The need for starting the tests within a reasonable time after receipt of sample is realized and it is hoped that though it is strictly not a technical requirement, it would help in correct interpretation of results. It is generally recommended that, as far as possible, testing organizations should commence tests on the batteries within a period of 30 days from the date of receipt of samples.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with

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\*Specification for lead-acid storage batteries for motor vehicles.

**IS : 2-1960\***. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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## **1. SCOPE**

**1.1** This standard specifies the ratings, overall dimensions and tests for lead-acid storage batteries of 6 and 12 V, used as a source of power in motor cycles and autorickshaws, for ignition, lighting and other auxiliary purposes. It may in specific cases where dynostarters or starter motors are used, also serve as a source for starting the engine.

**1.2** The batteries to be used as power source for starting the engine by dynostarters or starter motors shall meet the requirements of high rate discharge at normal temperature in accordance with 7.12.

## **2. TERMINOLOGY**

**2.0** For the purpose of this standard, the definitions given in IS : 1885 ( Part VIII )-1965† in addition to the following shall apply.

**2.1 Type Tests -Tests** carried out to prove conformity with the requirements of this standard. These are intended to prove the general quality and design of a given type of battery.

**2.2 Acceptance Tests** — Tests carried out on samples selected from a lot for the purpose of verifying the acceptability of the lot.

**2.2.1 Lot** — All batteries of the same type, design and rating, manufactured by the same factory during the same period, using the same process and materials offered for inspection at a time shall constitute a lot.

**2.3 Routine Tests** — Tests carried out on every battery.

## **3. MATERIALS AND CONSTRUCTION**

**3.1 Containers** — The battery shall be assembled in **monobloc** containers conforming to IS :1146-1972‡.

**3.2 Cell Lids** — The lids for individuals cells shall be robust and the design shall provide adequate depth for the sealing compound. It shall have acid-tight seals for the two terminals. ‘Mono-lid’ construction, that is, a single moulded lid to cover **mor.** than one cell may also be used for closing the tops of the cells.

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\*Rules for rounding off numerical values ( *revised* ).

†Electrotechnical vocabulary : Part VIII Secondary cells and batterb.

‡Specification for rubber and plastics containers for lead-acid storage batteries (first revision) .



**3.3 Battery Covers** — A suitable battery cover shall be provided.

**3.4 Venting Device** — Where single lids are used a separate vent plug shall be provided on each single lid which shall be of antisplash type preferably with more than one exit hole and shall allow the gases to escape freely. On removal it shall permit drawing of the electrolyte samples, servicing and checking of the electrolyte level.

3.4.1 Where 'mono-lid' construction is used, the cells may be vented into a common chamber. This chamber shall have at least two exit vents. Separate filling plugs which need not be vented, may be used in such cases to permit topping-up of cells to the correct level.

**NOTE** — In some batteries, particularly those where a venting chamber is used, it may not be possible to assess the electrolyte level by removal of the filling plug. In such cases, alternative provision for judging the electrolyte level shall be made. This may be done in case of plastic containers by using translucent plastics and marking the electrolyte level on the container itself.

### 3.5 Terminals

3.5.1 Terminals shall be in the form of threaded studs and nuts or lug-type with fasteners. .

3.5.2 Threaded terminals shall be of brass or mild steel, suitably protected from corrosion and shall comprise of either insert studs with nuts or insert nuts with studs. The inserts shall be firmly cast into the terminal mouldings.

### 3.6 Sealing Compound

3.6.1 Batteries with hard rubber containers and lids shall be sealed by means of bituminous compound which shall conform to IS : 3116-1965\*.

3.6.2 Batteries with plastic containers and lids shall be sealed by means, of plastic cement or similar materials. The sealing may also be effected by heating or by employing a suitable glue or a combination of both.

**3.7 Electrolyte** — The electrolyte shall be prepared from battery grade sulphuric acid conforming to IS : 266-1977†.

**3.8 Water** -~~Water~~ for storage batteries conforming to IS : 1069-1964‡ shall be used in the preparation of electrolyte and also to bring the level of electrolyte to approximately the correct height during the course of operation or testing.

### 3.9 Separators

**3.9.1** The synthetic separators shall conform to IS : 6071-1970§.

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\*Specification for sealing compound for lead-acid batteries.

†Specification for sulphuric acid (*second revision*).

‡Specification for water for storage batteries (*revised*).

§Specification for synthetic separators for lead-acid batteries.

**3.9.2** The wooden separators when used, shall conform to IS : 652-1960\*.

#### 4. RATINGS

4.1 The voltage and capacity ratings of the battery shall be assigned by the manufacturer and shall be chosen from Table 1. The capacity shall be expressed in ampere-hours, obtained when the battery is discharged at the 20-h rate, that is, at a constant current of  $Z = 0.05 C$  20 A until the terminal voltage falls to 5.25 V for 6-V batteries or 10.50 V for 12 V batteries, the capacity being corrected to an electrolyte temperature of 27°C ( see 7.10 ).

#### 5. CAPACITIES AND DIMENSIONS

**5.1** The capacities and corresponding maximum overall dimensions of batteries shall be as given in Table 1.

**TABLE 1 CAPACITIES AND OVERALL DIMENSIONS**

( Clauses 4.1 and 5.1 )

TYPE	VOLTAGE	CAPACITY	MAXIMUM OVERALL DIMENSIONS		
			Length	Width	Height
(1)	(2)	(3)	(4)	(5)	(6)
	V	Ah	mm	mm	mm
I	6	14	122	92	162
II	6	12	122	92	162
III	6	11	123	60	137
IV	6	9	123	60	137
V	12	7	136	60	132

#### 6. MARKING

6.1 The following information shall be legibly and durably marked on the outside of each battery :

- Manufacturer's name and/or trade mark,
- Nominal voltage and rated ampere-hour capacity and manufacturer's type,
- Whether for dyno-starting,
- Acid-level in case of translucent containers,
- Month and year of manufacture, and
- Country of origin.

\*Specification for wooden separators for lead-acid storage batteries ( revised ).

**6.2** In addition to the information given in **6.1**, the following information shall be given with each battery in the form of a label firmly attached to the battery:

- a) Month and year of manufacture,
- b) Last date of filling-in and charging, and
- c) In case of dry-charged battery, the date of expiry of dry-charged condition together with the instructions thereafter.

**6.3** The batteries may also be marked with **ISI** Certification Mark.

**NOTE** — The use of the **ISI** Certification Mark is governed by the provisions of the Indian Standards Institution ( Certification Marks ) Act and the Rules and Regulations made thereunder. The **ISI** Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard, under a well-defined system of inspection, testing and quality control which is devised and supervised by **ISI** and operated by the producer. **ISI** marked products are also continuously checked by **ISI** for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the **ISI** Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## 7. TESTS

### 7.1 Classification of Tests

**7.1.1 Type Tests-** The tests given under 7.1.1.1 shall constitute type tests.

**7.1.1.1 Sequence of tests and number of samples** — Six samples shall be drawn by the testing or inspecting authority. The sequence of tests shall be as indicated in the schedule below. A set of components representing those used in the battery shall be supplied, if required, for carrying out type test alongwith the batteries offered for type test.

Test	Battery Number					
	1	2	3	4	5	6
a) Physical examination ( 7.6 )	x	x	x	x	x	x
b) Test for materials and components ( if required by the purchaser ) ( 7.7 )	( on sample components referred above )					
c) Checking of dimensions ( 7.8 )	x	x	x	x	x	x
d) Air pressure test ( 7.9 )	x	x	x	x	x	x
e) Test for capacity ( 7.10 )	x	x	x	x	x	x
f) Vibration (7.11)	-	-	—	—	x	—

Test	Battery Number					
	1	2	3	4	5	6
g) High rate discharge ( for batteries for dyne-starting only ) ( 7.12)	×	×	×	×	—	—
h) Retention of charge (7.13)	—	—	x	X	—	—
j ) Resistance to overcharge (7.14)	—	—	—	—	x x	—
k) Life ( 7.15)	×	×	—	—	—	—
m) Storage ( 7.16 or 7.17 )	—	—	—	—	—	x

**NOTE 1** — In case of dry-charged batteries, the tests (a), (b), (c) and (d) followed by test according to **7.18** shall be carried out prior to the other tests. The batteries shall be recharged at the normal rate after the test according to 7.18.

**NOTE 2** — The inclusion of high rate discharge test shall be subject to agreement between the purchaser and the supplier.

7.1.1.2 If any of the samples fail in the relevant type test, the testing authority may call for fresh samples not exceeding twice the original number and subject them again to the test(s) in which failure occurred. If there is any failure in the retest(s), the type shall be considered as not having passed the requirements of this standard.

7.1.2 Acceptance Tests — The following shall constitute the acceptance tests.

- Physical examination ( 7.6 ),
- Checking of dimensions ( 7.8 ),
- Air pressure test ( 7.9 ),
- Capacity ( **7.10** ), and
- High rate discharge (for batteries, for dyno-starting only) ( 7.12 ).

**NOTE 1** — The inclusion of high-rate discharge test shall be subject to agreement between the purchaser and the supplier.

**NOTE 2** — In case of dry-charged batteries the above tests except (a), (b), (c) and (d) shall be carried out after the test specified in 7.18 followed by a recharge at the normal rate.

7.1.2.1 **Sampling scheme and criteria for acceptance** — The sampling scheme and the criteria for acceptance of a lot shall be in accordance with **5.1.4** of IS : 8320-1976\*.

7.1.3 **Routine Tests** — The following shall constitute the routine tests :

- Physical examination ( 7.6 ), and
- Air pressure test ( 7.9).

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\*General requirements and methods of test for lead-acid storage batteries.

**7.2 Test Equipment** — The voltmeters, ammeters, thermometers and hydrometers used for the tests shall comply with the requirements of 5.2 of IS : 8320-1976\*.

**7.3 Temperature for Tests** — The temperature of electrolyte during test discharge shall be within the limits of 20 to 30°C.

**7.4 Specific Gravity** — For the purpose of test requirements the specific gravity of fully charged batteries, corrected to 27°C shall be  $1.280 \pm 0.010$ .

**7.4.1** To correct the specific gravity reading to 27°C.

- a) Add 0.0007 to the observed hydrometer reading for each °C above 27°C, and
- b) Deduct 0.0007 from the observed hydrometer reading for each °C below 27°C.

**7.5 First Charge** — The first charge to the battery shall be given in accordance with the manufacturers' instructions.

**7.6 Physical Examination** — The batteries shall be examined visually for conformity to the requirements of 3.2.

**7.7 Test for Materials and Components** — If required by the purchaser the set of components representing those used in the battery shall be tested for conformity to various Indian Standards specified under 3.1, 3.6.1, 3.7, 3.8 and 3.9.

**7.8 Dimensions** — The dimensions of the batteries shall be checked in conformity with the requirements of Table 1.

**7.9 Air Pressure Test** — The sealing of each cell of the battery shall be checked by compressed air at a pressure equal to 700 mm of water. The volume of the tubes and auxiliary parts in connection with the cell under pressure shall not exceed 0.5 litre. The air pressure in the cell 15 s after the supply is disconnected shall be noted. The air pressure test shall be carried out in dry uncharged condition.

**7.9.1 Requirement** — The air pressure shall not fall from 700 mm to below 670 mm of water at the end of 15 s.

**7.10 Test for Capacity**

**7.10.1 At 20-h rate** — The battery shall be first charged according to manufacturer's instructions and when fully charged the level and specific gravity of the electrolyte of each cell checked and if necessary, adjusted. The electrolyte level shall be that recommended by the manufacturer and shall not be less than 6 mm over the top of separators.

\*General requirements and methods of test for lead-acid storage batteries.

7.10.1.1 Within a period of 2 to 12 h from the end of charge and with an electrolyte temperature of 20 to 30°C the battery shall be discharged at a constant current  $I = 0.05 C_{20}$  A, until the terminal voltage has fallen to 5.25 V in case of 6-V battery or 10.50 V in case of 12-V battery.

7.10.1.2 During discharge, the following values shall be checked and noted at suitable intervals:

- a) the battery terminal voltage,
- b) the discharge current, and
- c) the temperature of the electrolyte.

The measurements shall normally be taken hourly, but the voltage shall be checked at half-hourly intervals when the total battery voltage has fallen below  $1.80 \times n$  V where  $n$  is the number of cells in the battery and at 15 min intervals thereafter.

7.10.1.3 The capacity obtained by multiplying the rate of discharge in amperes by the duration of discharge in hours shall be corrected for the temperature by the use of the following formula:

$$C_{27} = \frac{C_t}{1 + 0.01(t - 27)}$$

Where

$C_{27}$  = the capacity in Ah at an average temperature of 27°C,

$C_t$  = the capacity in Ah obtained at an average electrolyte temperature of  $t^\circ\text{C}$ , and

$t$  = the average value in °C of the initial and final electrolyte temperature measured in the central cell(s).

7.10.1.4 After discharge the battery shall be recharged at the normal rate.

7.1.0.2 **At 10-h rate** — Alternatively batteries may be subjected to an equivalent 10-h capacity rate which shall be calculated by the following formula:

$$C_{10} = 0.88 C_{20} \text{ at } 27^\circ\text{C}.$$

7.10.2.1 The test shall be carried out in accordance with 7.10.1.1 to **7.10.1.3** with the discharging current  $Z = 0.1 C_{10}$  A. The battery shall be charged at the normal charging rate immediately after the discharge.

7.103 **Requirements** — The battery shall reach its rated capacity in three discharges.

NOTE — If as a result of the first or second discharge itself, the capacity is found to be equal to or above the rated value, it is not necessary to carry on the test further.

**7.11 Vibration Test** — The test shall be performed in accordance with IS : 2106 (Part XVI)-1971\*. The samples shall be first tested for capacity test at 20-h rate and recharge before putting on vibration test. The test shall consist of vibrating the batteries at a frequency of 16 Hz with a displacement of 5 mm for a period of 2 h. During vibration the batteries shall be discharged at  $Z = 0.05 \times C$  20 A.

**7.11.1 Requirement** — There shall not be any sudden drop, either in the current or voltage values and there shall be no spillage of electrolyte during the test.

**7.12 High Rate Discharge Test at Normal Temperature (Applicable for batteries for dyno-starting)** — After the 20-h rate of discharge in accordance with 7.10 the battery shall be tested at high rate of discharge at normal temperature.

**7.12.1** The high rate discharge capacity at normal temperature is determined by a discharge at a constant current of  $Z = 2.5 C$  20 A (for the single separation and  $Z = 2.0 \times C$  20 A (for double separation), the discharge being stopped when the battery terminal voltage falls to 4.00 V in case of 6-V battery and 8.00 V in case of 12 - V battery.

The initial temperature of the electrolyte measured in the central cell (s) shall be  $27 \pm 2^\circ\text{C}$ .

During discharge the terminal voltage shall be taken at 5 to 7 s after start and at 30 s interval thereafter.

**7.12.2 Requirements** — The battery shall meet the minimum requirements specified in Table 2.

**TABLE 2 REQUIREMENTS FOR HIGH RATE DISCHARGE**

SEPARATION	INITIAL TEMPERATURE OF THE ELECTROLYTE	DISCHARGE CURRENT	MINIMUM DISCHARGE TIME	BATTERY TERMINAL VOLTAGE			
				INITIAL (AFTER 5-7 SECONDS)		FINAL	
				6-V Battery	12-V Battery	6-V Battery	12-v Battery
				(5)	(6)	(7)	(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$^\circ\text{C}$	A	min	V	V	V	V
Single	$27 \pm 2$	$2.5 \times C_{20}$	5 30	5.00	10.00	4.00	8.00
Double	$27 \pm 2$	$2.0 \times C_{20}$	5 30	5.00	10.00	4.00	8.00

\*Environmental tests for electronic and electrical equipment : Part XVI Vibration test.

**7.13 Retention of Charge Test** — The battery shall be fully charged at the current specified by the manufacturer and the level and specific gravity of the electrolyte in each cell adjusted, if necessary.

7.13.1 The battery shall then be subjected to two consecutive capacity tests in accordance with 7.10, the initial capacity  $C$  being calculated as the **mean** of the two results obtained.

7.13.2 After a complete recharge and cleaning of electrolyte from its surface, the battery is stored for a period of 28 days, without disturbance, at a temperature of  $27 \pm 2^\circ\text{C}$ .

7.13.3 After 28 days of storage, the battery shall be submitted to a capacity test in **accordance** with 7.10. The value of the capacity measured after storage is denoted by  $C'$ .

The loss of capacity  $S$  expressed as a percentage is calculated from the following formula :

$$S = \frac{C - C'}{C} \times 100 \text{ percent}$$

**7.13.4 Requirement**— The loss of capacity shall not exceed 20 percent.

#### 7.14 Resistance to Overcharge **Test**

7.14.1 The battery shall be charged continuously at a current of  $I = 0.1 \times C$  20 A for a period of 100 h. Throughout this period, the battery shall be immersed in a tank of water the temperature of which is maintained at  $40 \pm 3^\circ\text{C}$ . The battery shall be so immersed that the top of the battery case is 25 mm above the water level in the tank. If several batteries are placed in the same tank, a distance of 25 mm shall be maintained between them. This distance between a battery and the sides of the tank shall be at least 25 mm.

7.14.2 When the overcharge is completed the battery shall be left disconnected in the tank of water at  $40 \pm 3^\circ\text{C}$  for a period of 68 h.

At the end of this period, the battery is subjected without recharging to a 20-h rate of discharge test in accordance with 7.10. However, the temperature correction for capacity shall not be applicable.

7.14.3 When the discharge is completed the battery shall be immediately subjected to the next cycle of overcharge, without previous charging.

Each period of 100-h charge and 68-h stand, constitute one overcharge cycle.

The cycle shall be repeated to give a total of 4 overcharging cycles, with checking discharges at  $I = 0.05 \times C$  20 A.



**7.14.4 Requirement** — Each of the four 20-h rate checking discharges shall give a duration not less than 80 percent of C 20 before the battery terminal voltage falls to 5.25 V in case of 6-V battery and 10.50 V in case of 12-V battery.

## 7.15 Life Test

7.15.1 After being fully charged the batteries shall be connected to a circuit which will enable them to be subjected to a series of discharges and charges as follows :

Discharge for 1 h at an average current of  $Z = 0.1 C 20 A$ .

Charge for 5 h at an average current of  $Z = 0.1 C 20 A$ .

7.15.2 Throughout the life test cycle, the batteries shall be immersed in a water tank, the temperature of which is maintained at  $40 \pm 3^\circ\text{C}$ .

The batteries shall be so immersed that the top of the battery containers shall not be more than 25 mm above the water level in the tank. If several batteries are placed in the same tank, a distance of at least 25 mm shall be maintained between them. The distance between the batteries and the sides of the tank shall also be at least 25 mm.

7.15.3 After each series of 36 discharge and charge cycles, the batteries shall be disconnected from the circuit. They shall be left on open-circuit in the tank for 96 h. After this open-circuit stand, the batteries shall be subjected to a checking discharge. Where high-rate requirements do not apply to the battery (see 1.1 and 7.12), the battery after 36 cycles and at the end of the 96 h stand shall be subjected to a 20-h discharge according to 7.10 but at an electrolyte temperature of  $40 \pm 3^\circ\text{C}$  and without any preliminary recharge. The capacity obtained shall not be corrected for temperature (see Table 3). The batteries for dyno-starting shall be given a high rate checking discharge in accordance with 7.12 (see Table 3). On completion of this discharge, the batteries shall be fully recharged at the normal rate.

7.15.4 The combination of 36 discharge and charge cycles, the 96-h open-circuit stand, the checking discharge and the recharge together constitute one complete unit of life test.

7.15.5 During this test the batteries shall be periodically topped up with pure water so as to maintain the correct electrolyte level. The fully charged specific gravity at each capacity test shall be maintained within limits of  $1.280 \pm 0.010$ , if necessary, by adjustment.

7.15.6 *Requirements* — When tested as described above the battery shall have a minimum life as follows :

Single separation — 3 units

Double separation — 4 units.

For each of the checking discharges the deviations of the discharge shall be not less than those specified in Table 3.

**TABLE 3 REQUIREMENTS FOR LIFE TEST**

(Clauses 7.15.3 and 7.15.6)

CHECKING DISCHARGE	INITIAL TEMPERA- TURE OF ELECTROLYTE	DISCHARGE CURRENT	MINIMUM DISCHARGE TIME			FINAL BATTERY TERMINAL VOLTAGE	
						6-VOLT	12-VOLT
						(5)	(6)
(1)	(2)	(3)	(4)			(5)	(6)
	°C	A	h	min	s	V	V
(a) 20-h Rate	40 ± 3	0.05 C <sub>20</sub>	16	00	00	5.25	10.50
(b) High Rate (when app- licable)	40 ± 3	3 G <sub>0</sub>	0	4	00	4.00	8.00

### 7.16 Storage Test

7.16.1 The battery shall be stored in dry uncharged condition for a period of 2 years from the date of manufacture at an ambient temperature of  $27 \pm 10^\circ\text{C}$  and a relative humidity not exceeding 90 percent.

7.16.2 Requirements — At the end of the storage period, the battery shall meet the requirements of capacity test (7.10) or high rate discharge test (7.12) (if applicable).

### 7.17 Storage (for Dry Charged Batteries)

7.17.1 The dry-charged battery shall be stored as per the manufacturer's instructions and with the manufacturer's seal intact at an ambient temperature of  $27 \pm 10^\circ\text{C}$  and a relative humidity not exceeding 90 percent for a period of  $365 \pm 7$  days. At the end of the storage period the battery shall be tested for capacity in accordance with 7.10.

7.17.2 Requirement — The battery shall give not less than 65 percent of its rated capacity.

### 7.18 Test for Dry-Charged Battery

7.18.1 The battery shall be tested within 60 days of manufacture.

7.18.2 The battery shall be maintained at a temperature of  $27 \pm 2^\circ\text{C}$  for 24 h prior to test.

7.18.3 The battery shall then be filled with electrolyte of specific gravity  $1.280 \pm 0.010$ . The temperature of the electrolyte before filling shall be  $27 \pm 2^\circ\text{C}$ .

7.18.4 Twenty minutes after the completion of filling, the battery shall be discharged at a constant current  $I = 0.05 C$  20 A until the terminal voltage has fallen to 5.25 V in case of 6-V battery and 10.50 V in case of 12-V battery. The readings during discharge and the calculation of capacity shall be noted as in 7.10.1.2 and 7.10.1.3.

7.18.5 **Requirements** — The battery shall give not less than 80 percent of its rated capacity.

( Continued from page 2 )

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